It's Not (just) Technology, It's the Market (stupid!)

Consumer Information for Promoting Greener Cars

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COMMENTS WELCOME

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It's Not (just) Technology, It's the Market (stupid!)

Consumer Information for Promoting Greener Cars

As we approach the 21st century, controlling transportation energy use and its attendant environmental impacts is a challenge that is both serious as well as technically and intellectually stimulating. Cars and light trucks account for 60% of U.S. transportation energy use and majority shares of other major pollutants.[1]

Transportation is the most tenaciously oil-dependent sector of our economy. Transportation petroleum use is the single largest contributor to U.S. fossil carbon emissions, exceeding even the emissions from coal used for electricity generation.

Developing country emissions are indeed growing rapidly, at least when their economies are growing. But most other country's CO_2 emissions are still dwarfed by those of the United States.[2] If it were a sovereign state, the U.S. car and light truck fleet would be the world's 5th largest emitter of CO_2 from energy use. Our light duty vehicles alone still exceed all of India in CO_2 emissions, for example.

For a number of air pollutants, we have been seeing steady progress through cleaner vehicle technologies. Carbon monoxide is on a clearly downward trend. Volatile organic compounds, or reactive hydrocarbons, show a generally downward trend, although problem areas remain.

Success is not quite as assured for nitrogen oxides. NO_x emissions have been reduced and the trend appears to be downward, but cars and light trucks still have the same share of the overall NO_x inventory as in the pre-control era.

Fine particulate matter, especially ultra-fine particles below 2.5 microns and even much

In the United States, Transportation accounts for

27% of energy use	23×10^{15} Btu
67% of petroleum use	11 Mbbl/day
32% of CO_2	432 MT_C/yr
80% of CO	63 MT/yr
45% of NO_X	9.4 MT/yr
36% of VOC (hydrocarbons)	7.5 MT/yr
19% of $PM_{2.5}$ (fine particle mass)	12 MT/yr
5% of SO_2	1 MT/yr

(MT = 10^6 metric tons)

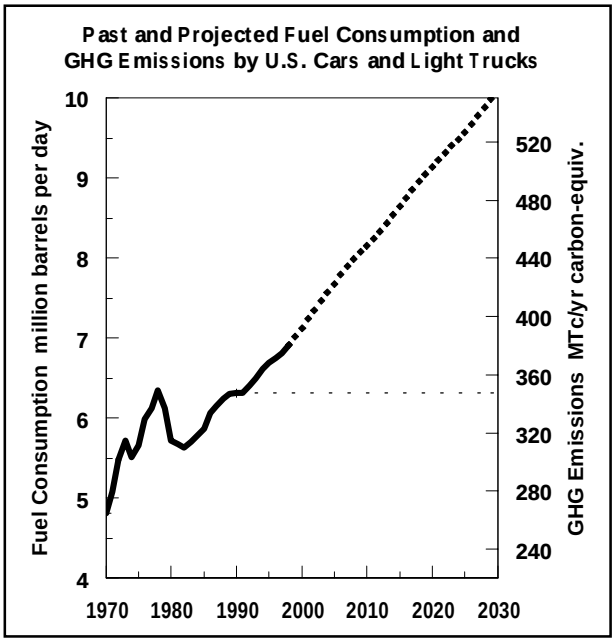
Trends in U.S. Automobile Emissions

Carbon Monoxide (CO)
Steady progress in emissions reduction, with a clearly downward trend.

Volatile Organic Compounds (HC, ozone precursor)
Generally downward, but problem areas remain; motor vehicles are a declining share of the inventory.

Nitrogen Oxides (NO_X)
Emissions have been reduced and trend appears to be downward, but car and light truck share of the inventory remains about the same as in the pre-control era.

Fine Particles (PM)
A serious concern for which new air quality policies are still being developed. Light duty gasoline vehicles are a small share of mass-based inventories, but further assessment and research is needed.



smaller, is a pollutant of growing concern for which better characterization and mitigation approaches are needed. The health damage caused by fine PM is not yet fully reflected in emissions standards, let alone effective control strategies.

Where there is no sign of progress is in controlling transportation CO_2 emissions. Fuel efficiency increases are now absent in automobiles. New light duty fleet efficiency peaked in 1988; stock turnover has now played out. Technology is improving, but not at rates or in ways that deliver higher fuel economy. Thus, automotive energy use and CO_2 emissions are rising in step with travel demand.

What is critical is whether the rate of deployment of greener technologies can compensate for the rate of growth in vehicle use, net of prospects for dampening that growth. For the foreseeable future, travel demand is rising steadily, driven by increasing population, economic activity, and income. Automobiles and other transportation services generate significant benefits for the economy. Global motor vehicle travel is likely to continue to rise for several decades, until invention and investments give rise to clearly superior modes of travel.[3]

POLICY CONTEXT

To date, societal concerns about the side-effects of automobile use have been addressed largely through regulations. As far as they directly shape vehicle design, these concerns include safety, the environment, and energy consumption.

Societal Concerns Influencing Vehicle Design

- **Safety**
- **Environment**
- **Energy**

Safety

Safety has been a major area of activity since the mid-1960s, when Ralph Nader elevated it to national attention. His exposés spurred the establishment of the National Highway Traffic Safety Administration and an ongoing series of Federal Motor Vehicle Safety Standards.

The regulatory focus on crashworthiness and restraints produced dramatic design improvements, resulting in declining trends in fatalities in spite of steady growth in VMT. Current issues include rollover and vehicle ag-

Influence of Societal Concerns on Vehicle Design

SAFETY

REGULATION

- Federal safety standards since 1966
- Focus: restraints, crashworthiness, crash avoidance
- Limitations: rollover, aggressivity

CONSUMER INTEREST

- Was historically very limited
- Stronger concern in recent years
- Some technologies deployed in advance of regulatory requirements (e.g., ABS)

gressivity. Recent studies are broadening the safety paradigm beyond crashworthiness, which emphasizes how well a vehicle protects its own occupants, to address compatibility, which considers the harm one vehicle inflicts on the occupants of another and on other road users.

Historically, consumer interest in safety was limited. Automakers shied away from it in advertising because of its implicit message about the dangers of driving. Now, times have changed and safety has become a selling point. Chrysler broke the ice in a big way for airbags.

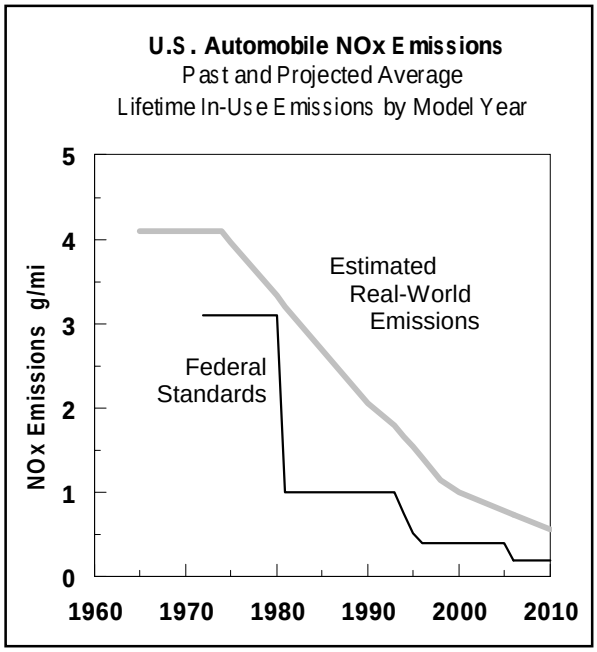
An indicator of the significance of consumer interest is whether it is strong enough to result in design changes that exceed regulatory requirements. We are now seeing that it has, in cases such as airbags. An even more notable example is anti-lock brakes, where deployment in passenger vehicles has been clearly market-driven. NHTSA's 1–5 star crash test ratings have also helped push crashworthy design beyond regulatory requirements.

Environment

California led the way in establishing vehicle emissions controls in the early 1960s. Federal regulations were authorized shortly thereafter under the Motor Vehicle Air Pollution Control Act of 1965. Regulations motivated the introduction of 3-way catalysts and ongoing refinements in emissions control technology. We now have on-board diagnostics as well as reformulated gasoline, but alternative fuels remain on the fringes of the market.

California attempted to change that with its Zero-Emission Vehicle mandate. Many supporters of the ZEV mandate now see its main value as accelerating the development of more viable electric drive technologies, such as hybrids and fuel cells.

By and large, emissions regulations have been quite successful. Tailpipe standards have



led to steadily declining emission rates. For example, per-mile nitrogen oxide emissions have been cut by about 75% compared to pre-control levels.[4] Regulatory efforts continue, with California's LEV-2 program now set and this year's federal rulemaking on Tier-2 standards. Steady declines in vehicle emissions will continue in the years ahead.

Influence of Societal Concerns on Vehicle Design

ENVIRONMENT (AIR POLLUTION)

REGULATION

- Federal standards established in 1965
- Focus: tailpipe emissions on lab tests
- California ZEV mandate
- Limitations: in-use performance for combustion engines; batteries not viable for widespread applications
- global warming not yet addressed

CONSUMER INTEREST

- Has been very weak
- Potentially emerging appeal, for example, corporate green image advertising
- No significant technology deployment in advance of regulations, but recent accelerated LEV introductions

Historically, consumer interest has not been a market driver for cleaner cars. Consumers essentially said to government and industry, hey, you guys fix the problem. However, this, too, may be changing. For one thing, the proponents of electric vehicles and other alternatives have had to confront the question of how to market those technologies. More broadly, however, environmental friendliness is beginning to have sales appeal. It is reflected in corporate image advertising and now more tangibly in accelerated nationwide introductions of low-emissions vehicles, led last year by Honda and with Ford stepping out this year with its nationwide LEV sport utilities and minivans.

In Japan, Toyota sold 18,000 of the Prius hybrid electric vehicle in its first twelve months on the market, exceeding the announced first-year expectations. The Prius is slated for U.S. and European introduction in 2000. Honda says it will beat Toyota to the punch for the U.S. market with its hybrid later this year.

At this point it is difficult to say whether these introductions really represent consumer interest beginning to get ahead of the regulatory driver, as it appears to have for some aspects of safety. LEV introductions can be viewed as fending off the spread of California standards, and the hybrid introductions can be viewed as a response to the ZEV mandate.

Energy

Energy did not become an issue until nearly a decade after safety and emissions. Following the OPEC oil embargo, Congress established the Corporate Average Fuel Economy standards. CAFE standards were passed in 1975 and first took effect in 1978. The rationale was economic and energy security. The law refers to the need of the nation to conserve energy, but it does not explicitly mention environmental factors. Global warming wasn't even on the radar screen.

The same economic and security rationales motivate alternative fuels policies. During the 1980s and through the Energy Policy Act of 1992, the only new energy-related drivers have been for alternative fuels. Alternative fuel programs try to paint themselves green, but at the federal level, they entail no environmental performance requirements beyond what is required for gasoline vehicles.

Influence of Societal Concerns on Vehicle Design

ENERGY

REGULATION

- Federal fuel economy standards established in 1975
- Establishment of AFV incentives in 1988 and fleet requirements in 1992
- Focus: economics and energy security
- Limitations: weak formal link of standards to environment, in spite of strong impact

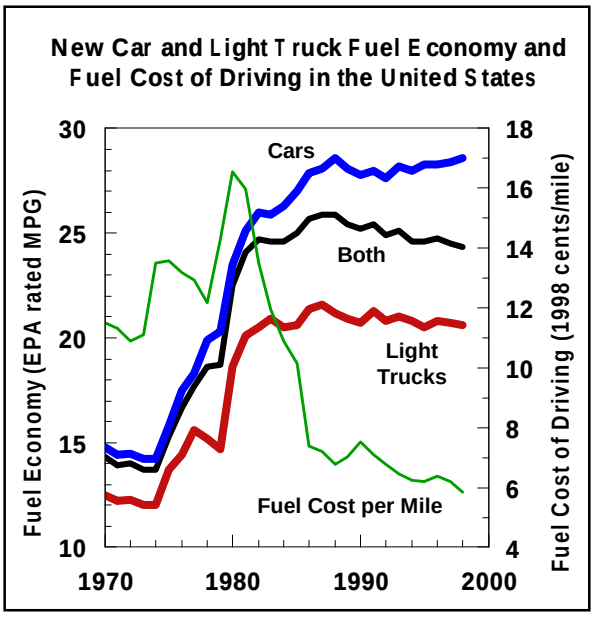
CONSUMER INTEREST

- Intense during oil crisis (high fuels prices plus gas lines)
- Weak since the mid-1980s and growing weaker
- Environmental link intuitively understood, but not well communicated by government, industry, or most media.

The thinking on fuel efficiency, particularly as formalized in policy, remains strongly tied to economic and security concerns. These factors worked quite well in the 1970s and early 1980s, when high fuel prices and the memory of gas lines put CAFE standards in sync with customer interest.

But today, gasoline prices are lower than ever. Early this year, local price wars dramatized the low cost of fuel, with some stations cutting prices to 60 cents per gallon. In January 1999, the average retail price of gasoline dropped to 98 cents per gallon, an all-time low in inflation-adjusted terms.

The adjoining chart plots new car and light truck fuel economy along with fuel cost per mile. Even before its recent lows, the fuel cost of driving -- the curve reading on the right-hand



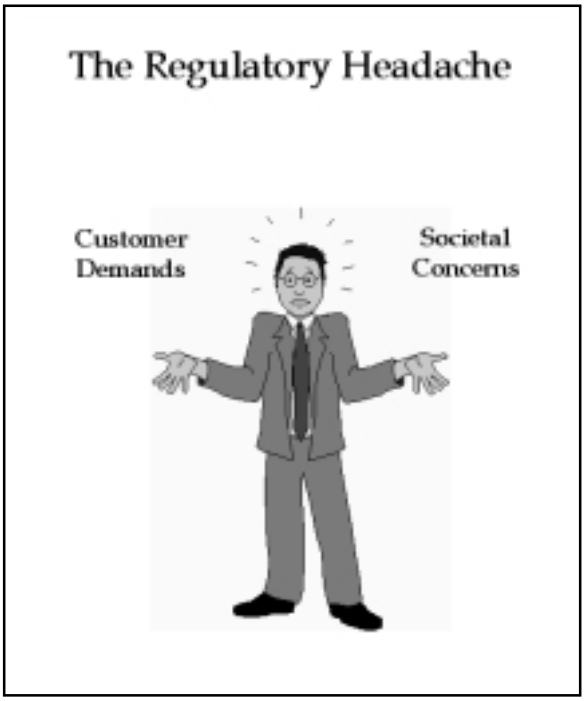
axis -- was less than 6 cents per mile. Adjusted for inflation, this value is half of what it was in the early 70s, *before* the oil crisis.

Otherwise put, if the price of gas were to double, that would barely restore it to the level of pocketbook importance it had in 1970. Back then, fuel economy was on a slow, post-war declining trend due to the previous generation's very natural, income-driven desire for performance, luxury, and other amenities, which happen to run counter to fuel economy.

Thus, new vehicle fuel economy is going nowhere. Many car and light truck fleets are pressing against the CAFE constraint and, with the ongoing shift from cars to trucks, the overall average continues to slide downward.

THE ESSENTIAL CONFLICT

Traditionally, societal concerns act largely as a constraint on design. That is because the designer has to build something in -- safety glass, seat belts, catalysts, whatever -- or take something out -- tailfins, a portion of performance -- that either doesn't have a customer payback or even detracts from customer value.



This tension between customer demands and societal concerns is what one might call the essence of the Regulatory Headache. It has perhaps never been more acute than it is now with the tension between market pulls for greater amenity and society's need to address global warming.

TECHNOLOGICAL PROMISE

How do we get beyond the conflict between what the market wants and concerns about its side effects? Clearly, one key part of the solution is technology. Some might even say that it is the whole solution, enabling us to address environmental concerns without sacrificing the benefits of mobility. The need for new technology is acknowledged in the PNGV[5] and the many private investments in researching "next-generation" automotive technologies.

Historically, for emissions and fuel economy, all of the progress made in the past has come from technical improvements. Improved vehicle design and technology have also greatly contributed to better safety.

Technological Options for Improving Light Duty Vehicle Fuel Economy

Technology Type	Fuel Economy Improvement*
Load Reduction	
Mass (material substitution)	10% – 40%
Aerodynamics	4% – 10%
Other	4% – 8%
Conventional Powertrain	
Variable Valve Control (VVC)	10% – 12%
Other PFI Spark Ignition Refinements	5% – 10%
Direct Injection Spark Ignition (DISI)	10% – 20%
DI Compression Ignition (DICI/diesel)	20% – 30%
Transmission	7% – 14%
Advanced Powertrain	
Hybrid Drive	30% – 60%
Fuel Cell	50% – 70%
TOTALS (adjusted for interactions)	
Mid Term (2010 – 2015)	33% – 75%
Long Term (2020 – 2030)	100% – 260%

*Relative to an average mid-1990s U.S. light duty vehicle rated at 25 mpg (9.4 L/100km).

The Technical Potential is Great

Certainly, many options exist that can increase fuel economy incrementally in the near term and substantially in the long term.

Load reduction, particularly lightweighting through material substitution, is fundamental. Approaches using lightweight metals can cut as much as 40% from vehicle mass. This level of weight reduction was demonstrated, for example, in the concept vehicles shown last year by Chrysler, Ford, and General Motors.

Conventional powertrains can still see many modest improvements that could add up to a significant near-term benefit, mostly without major breakthroughs. The upper end of the range is defined by diesel engines, which face emissions challenges for NO_x and PM.

A much larger potential comes from advanced powertrains, such as hybrid drive and fuel cells. Toyota's Prius, for example, delivers 50 mpg on the U.S. EPA test cycles. Adjusted for performance, it suggests about a 40% efficiency improvement for this first-generation hybrid drive technology. The U.S. version of the Prius is expected to meet California's super ultra-low emission vehicle (SULEV) standard.

Perhaps the most exciting development is fuel cells. Only a few years ago, this technology still seemed rather remote. But R&D has progressed rapidly, with major research investments and partnerships underway by all major automakers. Automotive fuel cells are still very much in a developmental stage; the most tangible commercialization plans, such as those of DaimlerChrysler, emphasize buses. Moreover, the best fuel and infrastructure for fuel cell vehicles is far from resolved.

Prognosticating future efficiency improvements involves much uncertainty. Nevertheless, putting it all together suggests a 33% – 75% potential fleetwide improvement in the near-term, meaning ten years or so. The lower end of this range, incidentally, is the voluntary target offered by European automakers for helping meet their climate protection obligations.

In the long run, fleet average fuel economy can certainly be doubled. Many are confident that an affordable tripling of fuel economy can be achieved by combining lightweighting and streamlining techniques with advanced powertrains such as hybrids or fuel cells. All of these options would have very low, if not zero, tailpipe emissions as well.

But How is Technology Directed?

Thus, whatever the technical potential is, it is not zero. We are not lacking for technology to address energy-related concerns. What we are lacking is a means of harnessing technology in ways that solve the problems at hand.

In fact, we are seeing ongoing improvements in the technical efficiency of motor vehicles. Over the past decade or so, engine specific power -- horsepower per cubic inch -- has increased by nearly 50%. A decade ago, the typical car engine put out about 40 hp/liter. Today this metric averages over 60 hp/liter.

Harnessing Technological Progress

ENGINE REFINEMENTS

- ➢ reduced friction, improved manifolds, overhead cams, 3-/4-valve heads, etc.
- ➢ specific power increasing by 3% per year

AERODYNAMIC IMPROVEMENT

- ➢ drag coefficient cut 10% or more upon each major redesign

LIGHTWEIGHT MATERIALS

- ➢ aluminum use increasing at 7% per year, up 111 pounds 1986–96
- ➢ extensive and growing use of plastics
- ➢ "ultra-light" steel techniques cut mass and parts counts, lower assembly costs

Progress Happens

The question is, how is it directed?

A LOT MORE AMENITY

Many market-driven features of customer value are going into cars and trucks.

PUBLIC GOODS

- ➔ improved crashworthiness
- ➔ improved emissions control

BUT ...

Over the past decade, we have seen a new light duty fleet average

- ↑ weight gain of 15% (480 pounds)
- ↓ fuel economy decline of 6% (1.5 MPG)

Similarly, aerodynamic drag is being cut with each round of redesign. A wide variety of material substitutions and other design changes offer reduced component mass along with many other benefits.

But most of this engineering capability is not helping the environment. With respect to fuel economy and greenhouse gas emissions, technical advances that could offer higher fuel economy are being gobbled up by the market to offer ever more power, luxury, capacity, and performance. The point is, "progress happens." The question is, how is it directed?

Unfortunately, not for environmental protection except as mandated. The partnership approach of PNGV restricts itself to R&D. The party line is, "we can invent our way out of this problem, we can invent our way out of the regulatory headache."

But it's not been happening. Market trends toward attributes that absorb technology without improving fuel economy continue without signs of abating. Developing technological solutions is clearly important, but it's not sufficient.

In other words, paraphrasing a campaign slogan of the not too distant past:

It's not (just) Technology,
It's the Market (stupid!)

So the question becomes, are there ways to tap into the factors underlying the market and cultivate new expressions of customer value, ones that are more in line with the deeper values that a majority of these same customers express as political support for stronger environmental policies? In short, are there ways we can make the market greener?

TOWARD A MARKETING APPROACH

I think that there are ways to make the market greener, and a starting point is better public information and education.

Now, everyone can agree that information and education are basic. But they are not seen as being very exciting, or as being strong levers for change. In fact, information about items like fuel economy is traditionally treated within a regulatory paradigm, where it is an aspect of the

public's "right to know" or information mandated to avoid deceptive advertising.

Information about the societal concerns that motivate regulation generally has not been treated in a marketing paradigm. It's not treated the same way that, say, 0–60 times are treated, or reliability ratings, or descriptions of 4-wheel drive capabilities -- information that is used to sell cars. Fuel economy data may be highlighted, for example, in economy segments of the market, but even then it is not very well tied to environmental protection.

If we can find ways, through marketing techniques, to elevate information about how vehicles measure up on societal concerns, we can enlist customer value in the service of societal goals. Otherwise put, we can then better reconcile what individuals as customers express in the showroom with the views that as citizens they express through public policy.

One thing that has become clear through recent social science research is just how well embedded environmental values are in our culture. I highly recommend the book by Kempton, Boster and Hartley, entitled *Environmental Values in American Culture.* Their work was based on surveys and interviews with people across the economic and political spectrum. If you get the book, you'll see its cover photo of a pickup truck that says a lot. It's got a load of hay in the bed, a loaded gun rack in the cab, and two bumper stickers on the tailgate. One says "rescue the rainforests," and the other one says, "nuke the liberal media."

Concern for the environment is not only the purview of card-carrying environmentalists. It is tied to deeper values, such as concern for one's children and the world they will inherit, and religious ethics of good stewardship over the earth and its creatures. Kempton and his colleagues found that appealing to such basic values may be more important than utilitarian arguments, such as the value of fuel savings.

Prospects for Consumer Green Interest in the Automotive Market

Environmental Values in American Culture

- A deep-seated concern for the environment is shared across the political spectrum
- Appealing to basic environmental values may be more important than utilitarian arguments

RECENT AUTOMAKER STRATEGIES

- Honda and Ford nationwide LEV offerings, related image and product advertising
- Many companies claim environmental concern and highlight green aspects of their products

PRODUCT DIFFERENTIATION OPPORTUNITIES

- Safety, reliability are becoming taken for granted
- Can product "greenness" provide a new angle?
- But little end in sight for more power, size, luxury

ACEEE'S EXPERIENCE

- Enthusiastic and greater than expected response to the *Green Guide to Cars and Trucks*
- Stimulated interest among public agencies and others for developing "buy green" campaigns

The potential of such appeals is reflected by emerging themes in advertising, with most companies now finding a way to tap environmental concerns.

Also, some traditional angles are becoming tapped out. There was once a big reliability race, but now, reliability is more and more taken for granted. Safety has become a more important means of differentiation than in the past, but it too, is showing signs of becoming an expectation rather than an enhancement.

If greenness were simply a matter of low tailpipe emissions, there might not be much opportunity, since ever-tightening standards so constrain the market. But given the importance of efficiency for reducing CO_2 emissions, vehicles have quite a ways to go in terms of better environmental performance. How much of a factor greenness can become is, however, very

much open to question. Little end is in sight for countervailing factors such as power, size, and luxury. The challenge, of course, is to sell affordable technologies that can do it all.

ACEEE's experience with the *Green Guide to Cars and Trucks* gives us reason to believe new opportunities are emerging for creatively addressing environmental problems. If ways can be found to tap the public's environmental values through marketing techniques, we may be able to alleviate the regulatory headache, to reduce the tension caused by public policies that force a manufacturer to sell products consumers don't seem to want.

A GREEN CONSUMERS' GUIDE

These prospects for tapping consumer values helped motivate us to publish the *Green Guide to Cars and Trucks.*

We were also motivated by the need to simplify information about the multiple facets of motor vehicle environmental performance. Fuel economy is fundamental for the global warming issue, but we realized we wouldn't get very far if efforts to communicate greenness were fragmented along single issues.

Just what is "greener," a consumer might ask. Lower tailpipe emissions or higher fuel efficiency? Recycled pop bottles in the bumper? Use of electricity, natural gas, gasohol, or some other alternative fuel? For environmental information to really make a difference, a more holistic approach is needed.

Green Rating Methodology

Therefore, we went back to the drawing board and developed an integrated approach that is capable of incorporating all of the many impacts that motor vehicles have on the environment. There is quite a lot to consider, and the quality and availability of data are obstacles on many parts of the vehicle rating question.

Designing a Green Rating for Automobile Environmental Impacts

Elements to Consider

- vehicle emissions
- fuel economy
- fuel cycle impacts
- manufacturing impacts
- disposal impacts and recycling

We took a life-cycle approach, developing, in effect, a streamlined life-cycle assessment for each make and model on the market, subject to the confines of publicly available data. Key inputs are fuel economy, fuel type, and the emissions standard to which a vehicle is certified. We count emissions at both the tailpipe and during fuel production, for example, at a refinery for gasoline or a power plant for electricity. Data on manufacturing impacts and material content is not published by make and model, so we base that part of the analysis on statistics linked to vehicle mass.

Details of our methodology are the subject of a talk unto itself.[6] The technical result of our calculations for each vehicle is what we term an environmental damage index (EDX). It is a sum of emissions estimates for various stages of the life-cycle, weighted by damage cost factors that represent the relative harm caused by different pollutants emitted in different locations.

Meaningful damage cost estimates don't exist for CO_2 and other greenhouse gases. So, because of their growing significance, we specified a factor such that greenhouse gases accounted for one-half of the total damage index for an average vehicle. In other words, we treat GHG emissions so that they are as important as criteria emissions in determining a vehicle's overall rating.

Communicating the Ratings

The EDX is a technical parameter, expressed in cents per mile averaged over a vehicle lifetime. To make it easier to understand, we converted it to what we call a Green Score by mapping it along a curve to a 0-100 scale. 100 is the perfect score, representing the probably unattainable ideal of zero environmental impact.

The guide is organized by vehicle size class, like most automotive consumer guides. We distinguish a model's configurations by engine, transmission, and emissions standard, listing the EPA fuel economy data and estimated annual fuel costs. The criteria emissions part of the environmental damage index is translated to an health cost estimate, to remind people that pollution does have a cost. We also translated the fuel economy numbers into tons of greenhouse gas emissions per year. We list the EDX, but emphasize the Green Score, for which a higher value represents a greener car.

The Green Score allows comparisons across the whole market. It is also designed to accommodate future vehicles on the same 0–100 scale, so that environmental progress can be seen from year to year. That makes the variations in score numerically small within a vehicle class or market segment for a given model year. But most buyers target a particular segment, and need to compare vehicles having similar characteristics.

Class Ranking Symbols

as used in ACEEE's
Green Guide to Cars and Trucks

✔	Superior
Δ	Above average
O	Average
∇	Below average
✘	Inferior

indicate a vehicle's environmental impact relative to others in its class.

Therefore, we spread out the distinctions by creating an indicator of how a given model compares to its peers. Each model is assigned a five-tier ranking symbol relative to others in its class. A check mark denotes models that are superior, that is, among greenest in their class, and other symbols denote above average, average, below average, and inferior environmental performance within the class.

GREEN INFORMATION STRATEGY

Our guide is one step in what can become a promising strategy of making greenness a much more visible aspect of automotive marketing. We will release it annually as a stand-alone publication targeting environmentally concerned buyers. This venture is a new one for us, and we have a lot to learn. We will be researching its understandability and usefulness so that we can refine it for future editions.

The guide is also an educational tool, and it is likely to be generally useful in helping others think about this emerging angle of the automotive market.

We are also using it to help guide demand-side market creation efforts that ACEEE and others are developing. Our approach identifies degrees of greenness throughout the market, rather than just highlighting certain alternative technologies. Therefore, it will be more broadly empowering for consumers, public fleets, and other institutions who might want to buy green but whose ability to do so is hampered when green is only defined as electric, natural gas, or some other choice still facing barriers with respect to price, availability, or utility.

We expect that the *Green Guide to Cars and Trucks* will be but one of many ways to expand the use of such information in automotive marketing. ACEEE will work with other information providers interested in using our Green Scores. For example, the 1999 edition of Jack Gillis's *Car Book*, published by Harper Perennial, has added green rating information based

ACEEE's Consumer Information Strategy for the Automotive Market

Stand-alone Consumer Guide

- Target environmentally concerned buyers
- Resource for public fleet administrators
- Keep green focus, not duplicating other information

Educational Tool

- Resource for automotive media
- Environmentally concerned individuals
- Explore use in schools, for young drivers

Guidance for Market Creation Efforts

- Facilitate "best-in-class" purchasing by public and private fleets
- Help develop "Green Machine Challenge" coordinated procurement program

Broaden Usage of Green Information

- Direct -- arrange for other information providers to use our Green Scores
- Indirect -- stimulate others to account for environmental factors in marketing and information provision

on our Green Scores. We hope to stimulate similar approaches that may be developed by others. We are advising DOE and EPA, and have offered suggestions to Consumer's Union and other organizations as they explore their own options for improving information on automotive environmental performance.

Consumer Information in Context

Consumer information and green marketing strategies alone will not transform the car and light truck market to greener technologies. It is important to place them in context along with other public policy mechanisms used to address societal concerns regarding motor vehicles.

One way to examine the policy context is in terms of what we call the market transformation paradigm. For improving energy efficiency, market transformation is the process by which new technologies enter the market and achieve substantial market share.[7]

Market Transformation Mechanisms for Greener Motor Vehicles

I like to represent the array of mechanisms for transforming the market to greener vehicles in the form of a pyramid (with apologies to the USDA food pyramid). At the top is R&D, clearly the enabling mechanism from which technological solutions flow. At the bottom, regulation provides a firm foundation. It is essential to ensure that technologies are applied throughout the market, in a timely fashion, and in a way that addresses the societal concerns which motivate public policy.

In between are sets of market-oriented tools that can help overcome the barriers that stand in between technology development and widespread deployment.

Commercialization programs and incentives focus on the supply side and help get new technologies introduced. Examples include fleet demonstrations as well as limited incentives, such as those available for alternative fuels and the tax credits recently proposed for advanced efficient vehicle technologies. Commercialization incentives are distinguished from broad-based market incentives by virtue of their more limited scope. They can help new tech-

nologies enter the market, but do not have a reach that is extensive enough to ensure widespread adoption.

Broad-based incentives are designed to influence the whole market, providing signals that can shift decision making by both the industry and consumers. In the United States, the only example we really have in place related to fuel economy is the gas guzzler tax. But higher fuel taxes and feebates have been proposed. Broader incentives exist in Europe, where much higher fuel taxes as well as differentiated vehicle taxes are common.

In the middle of the pyramid sit consumer information and educational strategies. These can have broad reach, but do not motivate the market as strongly as financial incentives. However, they are also less daunting politically. Given the promise of appealing to consumers' environmental values, these tools can perhaps be more powerful than we imagine. They might also enable stronger public policies by addressing the disinterest that creates opposition to other policies. The industry, the media, government agencies, and environmental groups all have roles to play in exploring how to make consumer information work.

CONCLUSION

To conclude, I think that information provision, and beyond it marketing campaigns based on environmental performance information, are underutilized among the set of options we have at our disposal to address societal concerns about cars and light trucks.

From a marketing stand point, it offers a new angle, a means of product differentiation, an opportunity to tap into a largely unexploited set of emotions and values we know that consumers have.

Looking down the road, I find the most promise in the possibility that greenness can become a fully vested aspect of product quality.

Something like performance, reliability, and more recently safety have become -- something that the market wants more of, that trades off with other attributes but also competes with them as a peer aspect of customer value. Then environmental quality can become an element of competitively-driven product improvement.

Such a vision, is of course, very ambitious compared to where we are today. I don't know if we'll get there. But it's worth a shot, and that's why we are investing in the *Green Guide to Cars and Trucks* and related marketing-oriented activities.

More modestly, perhaps we can look at the combination of consumer-oriented environmental information and green marketing as "Aspirin for the Regulatory Headache." It might not be the cure, but maybe it can relieve the symptoms. We'll still need regulation and still need R&D. But creative efforts in information provision, public education, and marketing might be just what the doctor orders to help treat what is the most challenging automotive ailment of today, namely, the conflict between where the market is headed and what has to be done to address global warming.

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NOTES

1 Davis (1998); EPA (1997). Light vehicle shares of overall transportation emissions are about 56/80 (70%) for CO, 23/36 (64%) for HC, and 24/45 (54%) for NOx, based on Hwang (1997, 10).

2 See comparison chart of CO_2 emissions by country on p. 99 of the *Green Guide to Cars and Trucks: Model Year 1999.*

3 See, e.g., Schafer and Victor (1997).

4 Based on Ross et al. (1997) and Hwang (1997).

5 The Partnership for a New Generation of Vehicles; see PNGV (1994).

6 DeCicco and Thomas (1999b); see also our forthcoming article in *Journal of Industrial Ecology*.

7 See Geller and Nadel (1994) for a general discussion of market transformation for improving energy efficiency, and DeCicco (1997) for automotive applications.